Classified cont.

FOR SALE: DRAKE T4X/R4A COMBO with spkr. & AC supply. Dual shifter installed, perfect conds - $650. ST-5 - $50. Uncompleted ST-6 as per photo Dec. '70 Journal, scope, cabinetwork, etc. - $95. SP-600JX, excellent with cabinet & manual - $175. All parts for deluxe 4-1000A amplifier including PS& cabinet, pickup only - $125. Uncompleted 5 digit Nixie 10 MHZ frequency counter, all parts included-$85. Model 28LPR 3-speed typing reperf, like new - $150. Send S.A.S.E. for list and detailed information. All FOB Brunswick, Maine except as noted. L.L. Filby K1LPS, Patrol Squadron 11, NAS, Brunswick, Maine 04011.

WANTED; ELECTRONIC TYPEWRITER for "Royaltyper", T-330 magnetic tape deck for CDC "Typetronics", 33 ASRs, 8 level readers/punches. Send list and prices. Fred Hatfield, K8VDH, Drawer 27100, Columbus, OH. 43227.

FOR SALE: ALLTRONICS-HOWARD TU Model I with scope tuning indicator and plug-in discriminator for Collins. Paul J. Nutter, W4JUR, 2501 Fall Hill Avenue, Fredericksburg, Virginia.

*****

CONVERTER, AN/SGC-1, with automatic keyboard send control and AFSK oscillator, $145; M-28 RO Base, $11; TDMS Distortion Measuring Test Set, Receive & Transmit units, $125/set; Digital DB meter, $40; CV-278/GRC late model FSK Converter, $105; M-14 TD, $25; M-14 reperf, $28; BE-77C Teletype Line Unit, measures and corrects bias on teletype signals, $22; Kleinschmidt page printer, can operate up to 100 wpm, $95; ED-51-DT Teletype test set, $35; Electronic Frequency Counter, HP-521C, $99. FACSMILE paper and equipment. 11/16" perforator tape, 40 rolls/$8. Send for big free list. Jim Cooper, POB 73-R, Paramus, NJ 07652.

21ST ANNUAL DAYTON HAMVENTION will be held on April 22, 1972 at Wamplers Hara Arena. Technical sessions, XYL programs, flea market, etc. For information write Dayton Hamvention, Dept. R Box 44, Dayton, Ohio 45401.

MAINLINE TT/L-2, with scope $200, or best offer. See picture in April RTTY Journal. WB4RKA, R. Wanat, 443 Atlas Dr., Madison, Ala. 35758.

WANTED; SERIES TYPE, GOVERNOR MOTOR (115 volt AC or DC) for 28 KSR Teletype. Elmer Rowekamp, 8850 West Midland Drive, Greendale, Wisconsin 53129.

*****

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MARCH 1972

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VOLUME 20 No 3 30 Cents

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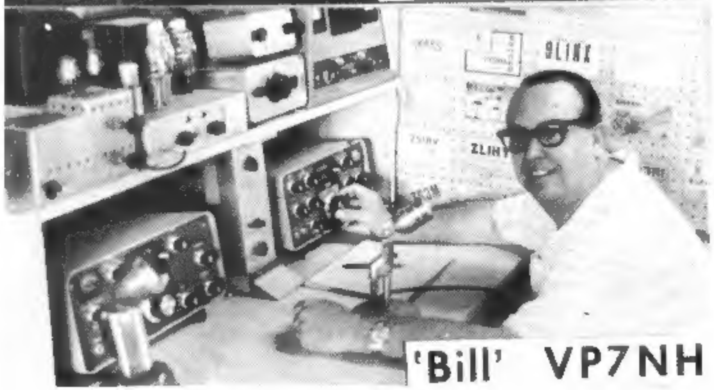


'Bill' VP7NH

CONTENTS

BARTG SPRING RTTY CONTEST 2
COMMENTS ON FASTER SPEEDS 2
THE TT/O 3
OSCAR 6 7
THEORY & APPLICATIONS 8
DX NEWS 10
A JUNK BOX AUDIO GENERATOR 11
HITS & MISSES 13

BARTG Spring RTTY Contest

The British Amateur Radio Teleprinter Group will hold their Spring RTTY Contest at 0200 GMT Saturday March 25th until 0200 GMT Monday March 27, 1972. Total contest period is 48 hours, but not more than 36 hours of operation is permitted (including listening time). SWL RTTYers are invited to participate.

Messages to consist of time GMT, message number and RST.

Points - all two-way RTTY contacts with stations within one's own country will receive 2 points, and all others 10 points. Bonus of 200 points per country worked including one's own. **NOTE** - any one Country may be counted if worked on separate bands, but Continents are counted only once.

Scoring. (a) Two-way exchange points times total Countries worked.

(b) Total Country points times number of Continents worked.

( ) Add (a) and (b) together to obtain final score. Separate page of Log for each band and indicate rest periods. Logs to contain Time GMT, Message and RST sent and received and exchange points claimed. All Logs must be received by May 31st, 1972 to qualify. Send to Ted Double G8CDW, B.A.R.T.G. Contest Manager, 89 Linden Gardens, Enfield, Middlesex, England.

AWARDS - Certificates will be awarded to the leading RTTY stations and SW listeners. The final positions in the Results Table will be valid for entry in the "World Champion of RTTY" Championship. The Judges decisions will be final and no correspondence can be entered into in respect of incorrect or late entries. Unsportsmanlike operating will be deemed sufficiznt reason for possible dis-qualification.

*****

Comments on Faster RTTY Speeds

With the regulations, permitting various speed for amateur teletypwriter operation, only a few weeks old it is too soon to make any conclusions.

There are indications that some problems will arise. Some planning and "unofficial" procedures will have to be developed to prevent confusion and develop the potential of the faster speeds in the right places and right times.

The biggest initial problem seems to be determining the speed of a transmission at the receiver. We have heard of electronic devices that will do this-hopefully someone can come up with a not too complicated article that we can publish to accomplish this. Other suggestions have appeared, two of them we are reprinting below and we will be very happy to act as a clearing house for other ideas.

In the mean time we will be pecking away on 60 WPM.

■

The following information was discussed and met with favorable response at a recent meeting of the CATS in Chicago. Comments from other readers or groups will be appreciated.

With the finalization of Dockett 19110 authorizing amateur radio teletype speeds of other than 60WPM serious thought has been given to the confusion and incompatibility that would occur if all AFSK operation were conducted on present standard 2125 mark and 2975 space tone frequencies.

With the greatest consideration given to amateurs utilizing present 60 wpm and 850 or 170 shift, it is felt this problem can be minimized or eradicated completely by immediate action in the form of a proposal for standards in operation of amateur AFSK radioteleprinter systems.

The basic plan calls for standardized tomes depending on the speed of operation. Namely - 60 wpm, using tones above 2000 Hz . . . 75 wpm using 1615 Hz mark and 1785 Hz space tones . . . 100 wpm using 1275 Hz mark and 1445 space tones. 67 wpm is not included as it is usually confined to low frequency, international FSK operation. The terminal units can use inexpensive toroid inductors and capacitors.

Under this plan the auto-start would only respond to the correct tones for the speed of the machine being operated and the machine would not turn on while other speeds are being used on the same channel. Other more advanced approach would be to use a 100 wpm machine with an electronic speed converter which would automatically have its input switched depending on which autostart was activated. Another suggestion for universal calling of manually or automatically speed switching machines

CONTINUED ON PAGE 12

The TT/O A Handy Piece of Equipment--

REPRINTED From QST- MAY 1966

IRVIN M. HOFF, W6FFC
12130 Foothill Lane
LOS ALTOS HILLS, CA. 94022

Here's a simple solution to what ordinarily is a tough problem — measuring audio frequencies with high-enough accuracy to determine a frequency change within a few cycles. It takes only a few readily-obtainable components and practically no construction.

This popular piece of equipment by Irwin Hoff, W6FFC which appeared in QST, May, 1966 was an instant hit among RTTY fans at the time. It wasn't long until anyone with a digital counter was busy helping friends calibrate it over the air. This editor built one and we have used it ever since with our Heath scope. Frankly it is one of the handiest gadgets in the shack and we would be lost without it. Knowing that there are a lot of new RTTY fans since this article was published and many do not have a file of QST going back that far we are reprinting it. There are a great many more digital counters in use now but if you don't have one the TT/O will answer the purpose and it is in the circuit all the time - transmit or receive.

**

Accurate setting of frequency shift for transmitting radioteletype is probably the most elusive difficulty encountered by amateur operators. A related problem is accurate tuning of the filters used in the demodulator, for optimum reception of incoming signals.

While designing some multi-pole audio filters for RTTY that required each section to be accurately tuned to a specific audio frequency, the author used a simple technique that is readily adaptable to other applications, such as

(1) Measuring the shift of any RTTY signal being received.

(2) Setting the transmitter quickly and accurately to an incoming signal without using loudspeakers or headphones.

(3) Keeping a "cold" transmitter on frequency.

(4) Estimating transmitter drift over, say, an hour's time with reasonable accuracy.

(5) Quickly and accurately setting the f.s.k. shift of the local transmitter to shifts other than 850 or 170, and then returning to the previous setting accurately.

Thus the "Mainline TT/O Semi-Counter": two extremely sharp filters of 20–25 cycles bandwidth, one of which is tuned to a fixed frequency of 2125 cycles and the other is adjustable by means of a precision capacitor substitution decade box. The two filters are connected to an oscilloscope that displays a "+" pattern when the signal is properly tuned.[2]

The TT/O Semi-Counter is not particularly designed to replace the normal visual display on the demodulator, but to complement and augment such a display.

The 88-mh. Toroid

The common 88-mh. toroid has a very high *Q*, around 118 at 2125 cycles, and the *Q* rises linearly to about 157 at 2975 cycles. When isolated properly to take advantage of this high *Q*, a simple tuned-circuit filter using the toroid will have a bandwidth of 17–20 cycles (see Fig. 2). It is unlikely that such isolation can be conveniently achieved, but it is easily possible to keep the bandwidth down to 20 to 25 cycles. The *Q*s of the filters in Mainline TT/O Semi-Counter are about 85 at 2125 cycles and 120 at 2975 cycles.

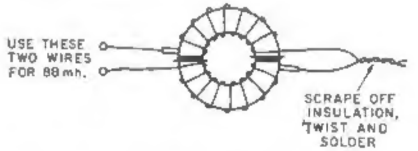

USE THESE TWO WIRES FOR 88 mh.
SCRAPE OFF INSULATION, TWIST AND SOLDER

Fig. 1—The 88-mh. toroid. The two windings must be connected in series to give an inductance of 88 mh.

For a number of reasons, such filters are much too narrow for general reception of 60-w.p.m. RTTY signals, but they certainly make optimum displays possible for tuning purposes, for setting the transmitter on frequency and maintaining that frequency, for adjusting the f.s.k. shift, and other interesting applications.

Little we have said so far will be very new to many readers. The new "twist" to the Mainline TT/O Semi-Counter is the use of a capacitor substitution decade box.

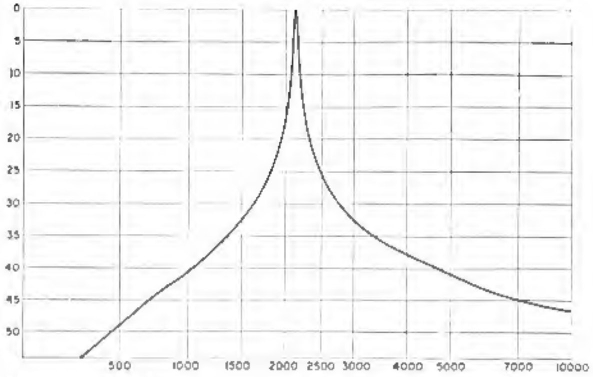
The author has found, after working with many 88-mh. toroids from a variety of suppliers, that for the most part they are wound to extremely close tolerances. In checking the resonant frequency with the same capacitor across a dozen different toroids, a variation of only 10–15 cycles was noted. *However*, using various capacitors across the same toroid was something else again.

Take the mark tone of 2125 cycles, for instance. A 0.068-μf. capacitor is often used across an 88-mh. toroid to tune to this frequency. If the capacitor has a 10% rating (about the best you will find in the local store or mail-order catalog) it can vary from 0.0612 to 0.0748 μf. and be

---

[2] Hoff, "RTTY Indicator Systems," *QST*, October, 1965.

Fig. 2—Single-tuned 88-mh. toroid filter for 2125 cycles. This circuit has a very high unloaded Q of 118. The bandwidth is only 18 cycles. Vertical axis in db., horizontal axis in cycles per second.



within limits. In frequency this would correspond to 1962 to 2168 cycles. Quite a variation! — *over 200 cycles* for a 0.068-μf. capacitor that is within limits. With a 1% capacitor the variation would be around 20 cycles.

The answer, of course, is to use 1% capacitors, at least for one standard reference filter from which others can then be duplicated. Here is where the capacitor substitution decade box comes in.

The Capacitor Substitution Decade Box

The capacitor substitution decade box uses all 1% capacitors, and is adjustable in 100-pf. steps from zero to 0.111 μf. These boxes are available in kit form and sell for $17.95 (Knight Kit Model 1180-K, Eico Kit 1180, and Heath Kit IN-21, to name three). The box will be useful not only in the Mainline TT/O Semi-Counter for day-to-day use, but also for tuning filters that may be constructed for the demodulator and in other applications around the RTTY station. Tuning filters is a job that most dread to such an extent that very few even bother, but with a piece of test equipment such as the capacitor substitution decade box tuning filters quickly and accurately is quite easy.

Tuning Toroids

An 88-mh. toroid that appears to be "brand-new" and has had no turns of wire removed from it should be chosen for use in conjunction with the capacitance decade box as a standard reference. Other toroids and capacitors to be used in filters are then tuned against the reference combination. Their actual values will be rather immaterial — either a few turns of wire will be removed from the toroid to match the capacitor, or a few smaller capacitors may be connected in parallel to achieve the proper frequency. This process does not take long, nor does it require expensive components of close tolerance.

If the capacitor substitution box is connected across the standard reference toroid, any specific frequency from 2125 to 3150 may be "tuned" immediately by referring to Table I. This enables the operator not only to select specific audio tones for various purposes, such as tuning filters, but also to measure the frequency of an unknown tone. It forms the basis of reading shifts with the Semi-Counter.

Setting Up The TT/O

Referring to Fig. 3, the 2.2-megohm resistor provides suitable isolation to keep the Q of the toroid quite high, and thus very sharply resonant. (The input resistance of the scope will typically be 3-6 megohms and also has little effect on the Q.) By changing the capacitance between points A and B, the frequency to which the filter will respond will be changed accordingly. This is the circuit used in setting up the Mainline TT/O.

Use the standard reference toroid and the capacitor substitution box for L and C, respectively. Referring to Table I, set the box to 0.0637 μf. The filter will now be tuned to within a very few cycles of 2125 — again, of course, assuming that the 88-mh. toroid you selected was "new". Adjust the audio source so that the scope shows maximum indication. (The audio source can be an audio oscillator, a receiver tuned to a 100-kc. calibrator point to give steady tone, a tape recorder, or other oscillator of some type.

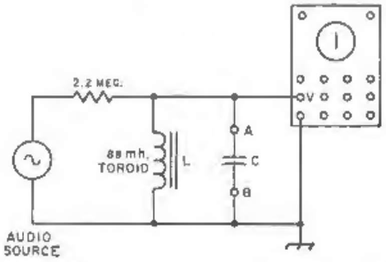


Fig. 3—Tuning the toroid to a specific frequency. The audio source can be a variable-frequency audio oscillator, a receiver tuned to a 100-kc. calibrator point, or a tape recorder with a standard tone. Use only Mylar-type capacitors.

In any event, allow the audio source ample opportunity to warm up so that it will be stable — in the case of the audio oscillator, a few hours; in the case of the receiver, overnight. The setting of the audio source is then left unchanged and it in turn becomes a "standard" against which the 2125-cycle fixed-frequency filter can be tuned. The following steps outline the procedure used in tuning the 2125-kc. filter.

1. Remove the standard 88-mh. toroid and replace it with any other 88-mh. toroid.
2. Connect a 0.06-μf. capacitor across the toroid, leaving the decade box in the circuit.
3. Set the decade box for maximum scope indication.
4. Read from the decade box the additional capacitance that must be added to 0.06 μf to tune the toroid to 2125 cycles.
5. Add the required amount and again adjust the capacitor decade box, to see if any small additional capacitance is needed. If not, and the indication is not as great on the scope as with the decade box alone, the added capacitance was too large. In this case, remove a few turns of wire from the toroid. Each turn removed will raise the frequency about 3 cycles around 2125 cycles.
6. After you think the 2125 filter is adjusted about right, remove the decade box and readjust the audio source to show maximum deflection on the scope.
7. Remove the 2125 filter, and replace with the standard reference 88-mh. toroid and decade box. Again adjust the decade box for maximum scope deflection without touching the audio source.
8. Read the value on the decade box and compare against the values in Table I to see if any small corrections could advantageously be made to the 2125 filter. From Table I, each 100 pf. added will lower the tone about 2 cycles, and each turn removed from the toroid will raise the tone about 3 cycles. (At 2975 cycles, each 100 pf. added will lower the tone about 5 cycles and each turn of wire removed will raise the tone about 4.5 cycles.)

Many variations will become apparent as the operator gains a bit of experience. At any rate, the use of the method explained and retention of a standard reference toroid will make tuning filters simple and easy — and best of all, very likely will surpass any accuracy previously achieved.

Checking Shifts

Most demodulators amplify the audio tones used for mark and space prior to rectification in the detector stage. These a.c. voltages usually reach 50–100 volts or more. The Mainline TT/O Semi-Counter is connected to the demodulator at these points through very high resistances to keep the filters extremely narrow for optimum tuning. This also makes possible the basic purpose of the Semi-Counter: that is, to measure shifts by utilizing the very sharp filters appropriately.

Figs. 4 and 5 show how the Mainline TT/O can be quickly connected to the Mainline TT/L F.S.K. Demodulator[3] as well as showing the actual circuit of the Semi-Counter. It should be easy to adapt the Semi-Counter to whatever demodulator is in use.

In checking f.s.k. shifts, first tune the receiver for maximum mark indication on the scope. Then vary the capacitor decade box for maximum space presentation. Note the setting on the box and refer to Table I. After this setting has been noted, the operator can return the box to 0.0325 for 2975 cycles and retune the receiver for "straddle-tuning" the incoming signal for best copy.

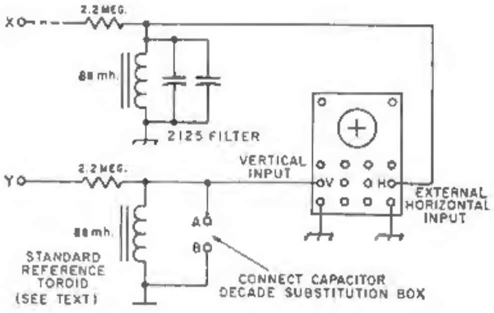

X
2.2 MEG.
88 mh.
2125 FILTER
Y
2.2 MEG.
VERTICAL INPUT
V
H
EXTERNAL HORIZONTAL INPUT
88 mh.
STANDARD REFERENCE TOROID (SEE TEXT)
A
B
CONNECT CAPACITOR DECADE SUBSTITUTION BOX

Fig. 4—Basic circuit for the Mainline TT/O Semi-Counter.

Checking Transmitter Drift

Most receivers (after 5–6 hours warmup) are quite stable. Many of the newer receivers will hold a frequency within a few cycles in an hour's time. (Temperature variations in a room will change this picture considerably, of course.) Transmitters, on the other hand, seldom will match a receiver for stability regardless of how long they have been running. While it is not unusual to run a receiver 24 hours a day (many enthusiasts *never* turn their receivers off, and this is indeed highly recommended), few would care to turn on a transmitter more than a few minutes prior to its use.

Under these circumstances, all but crystal-controlled transmitters will drift considerably more than most individuals would think, during the first hour or two. If the owner is curious as to just how stable his transmitter *really* is, the Mainline TT/O Semi-Counter will show him very quickly. Let the receiver warm up overnight at least so it can be relied on as much as possible as an accurate standard. Then turn the transmitter on. Tune it for a beat tone of say 2700 cycles with the decade box on the Semi-Counter set at 0.0395 μf. Then, at time intervals selected as convenient, vary the decade box for maximum scope presentation. By comparing against Table I the transmitter drift can be rather accurately estimated. By keeping track over a period of a few hours, it will become obvious just how long it really takes for the transmitter to settle down.

Keeping the transmitter on frequency is one of the fringe benefits of the Semi-Counter. The filters are so sharp that drift of 15 or 20 cycles will cause nearly a 25-percent change in the size of the scope pattern. As a result, any drift will be

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[3] Hoff, "The Mainline TT/L F.S.K. Demodulator," *QST*, August, 1965.

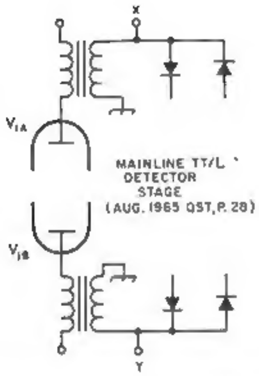


Fig. 5—Adapting the Mainline TT/O Semi-Counter to the Mainline TT/L F.S.K. Demodulator. The device adapts equally well to the detector stage of most other demodulators or converters.

few amateurs apparently have the foggiest notion of what 850 shift really is, and you will be amazed at the actual shifts in common use. They range from 550 to 1050 cycles and even occasionally beyond these extremes. Probably 80–90 per cent of the fellows are running around 775–810 shift.

Only a handful are close to 850, although about 1 out of 10 are *well* over 900 shift.

quickly noticed. Thus the operator can come on frequency with a "cold" transmitter, and although frequent adjustments may be needed they can be made quickly and accurately in order to stay on a specific frequency.

Accuracy

The Semi-Counter will not compete directly against a digital audio counter for accuracy. However, with a little care in tuning the 2125 filter accurately, and with some practice in the use of the Semi-Counter, an operator with normal skill can readily-enough determine shifts to within 5–10 cycles. You will soon discover that very

The Semi-Counter could well become one of the most useful items in the RTTY station. Several enthusiastic amateurs now using it have expressed amazement that they were able previously to get along without such a device at all. We hope you will find as much satisfaction in using the circuit as the rest of us are having.

(The "TT/O" part stands for two toroids and an oscilloscope, for those who have to know!)

*****

TABLE 1

Calibration Chart For 88 Mh. Toroid and Decade Box

Shift is measured in c.p.s. with respect to 2125 cycles.

pf.	*Shift*	*Freq.*
0.0290	1025	3150
	5	
0.0295	999	3124
	5	
0.0300	973	3098
	5	
0.0305	947	3072
	5	
0.0310	922	3047
	5	
0.0315	898	3023
	5	
0.0320	874	2999
	5	
0.0325	850	2975
	5	
0.0330	828	2953
	4	
0.0335	806	2931
	4	
0.0340	784	2911
	4	
0.0345	763	2888
	4	
0.0350	742	2867
	4	
0.0355	722	2847
	4	
0.0360	703	2828
	4	
0.0365	683	2806
	4	
0.0370	604	2780
	4	
0.0375	645	2770
	4	
0.0380	627	2752
	4	
0.0385	609	2734
	4	
0.0390	592	2717
	4	
0.0395	575	2700
	3	
0.0400	558	2683
	3	
0.0405	541	2666
	3	
0.0410	525	2650
	3	
0.0415	509	2634
	3	
0.0420	493	2618
	3	
0.0425	477	2602
	3	
0.0430	462	2587
	3	
0.0435	447	2572
	3	
0.0440	432	2557
	3	
0.0445	418	2543
	3	
0.0450	404	2529
	3	
0.0455	390	2515
	3	
0.0460	376	2501
	3	
0.0465	363	2488
	3	
0.0470	350	2475
	3	
0.0475	337	2462
	3	
0.0480	324	2449
	3	
0.0485	311	2436
	2	
0.0490	299	2424
	2	
0.0495	286	2411
	2	
0.0500	274	2399
	2	
0.0505	262	2387
	2	
0.0510	250	2375
	2	
0.0515	239	2364
	2	
0.0520	228	2353
	2	
0.0525	216	2341
	2	
0.0530	205	2330
	2	
0.0535	195	2320
	2	
0.0540	184	2309
	2	
0.0545	170	2295
	2	
0.0550	163	2288
	2	
0.0555	152	2277
	2	
0.0560	142	2267
	2	
0.0565	132	2257
	2	
0.0570	122	2247
	2	
0.0575	112	2237
	2	
0.0580	103	2228
	2	
0.0585	93	2218
	2	
0.0590	84	2209
	2	
0.0595	74	2199
	2	
0.0600	65	2190
	2	
0.0605	56	2181
	2	
0.0610	47	2172
	2	
0.0615	38	2163
	2	
0.0620	30	2155
	2	
0.0625	21	2146
	2	
0.0630	12	2137
	2	
0.0635	4	2129
	2	
0.0637	0	2125

These represent 500-pf. steps on the decade substitution box. The small figures between steps are the cycles for each 100 pf

OSCAR 6 & RTTY

ELMER MOORING, W3CIX
9318 Millbrook Rd.
Ellicott City, MD 21043

PART 2

LATEST SCHEDULES

Last month's column described the planned launch of the AO-B amateur radio satellite; however, as often happens in space efforts there have been scheduling changes. The AO-B launch will be delayed due to difficulty in getting the subsystems assembled in time for the early launch date. In order to utilize the space available on the ITOS-D launch vehicle, a more austere satellite is being prepared for this summer's launch. This satellite is designated AO-C and will be given the OSCAR number upon successful orbit. AO-C will contain the AMSAT 2 to 10 meter multi-access translator (linear repeater), a Morse code telemetry system, and the W5CAY CODESTORE system. CODESTORE is designed to receive, store, and retransmit coded messages and modifications are being planned to enable storage and retransmission of RTTY messages (to be described in a future column). The RTTY telemetry encoder and other two repeaters described last month are reserved for the rescheduled launch of AO-B. Although omission of the RTTY telemetry encoder removes the necessity for RTTY stations in the telemetry recovery loop, communications through this satellite by RTTY and SSTV are encouraged. The remainder of this month's column is devoted to the technical aspects of communicating through AO-C.

AMSAT 2 TO 10 METER TRANSLATOR

Results of the OSCAR 5 satellite in 1970 demonstrate the usefulness of 10 meters for a spacecraft repeater. The AO-C 2 to 10 meter translator is a multiple access linear repeater which receives uplink signals between 145.900 and 146.000 MHz and retransmits them between 29.550 and 29.450 MHz on the downlink. Sideband inversion takes place in the process; thus, normal FSK at 145.92 MHz (uplink) would become inverted FSK at 29.54 MHz (downlink). A satellite receiver input of -100 dBm (2 microvolts/meter) yields full transmitter output of 1 to 2 watts. Compare that to the 180 milliwatts output from OSCAR 5. The transmitter driver stage has additional inputs for telemetry and CODESTORE. The 2 meter antenna is circularly polarized and the 10 meter antenna is a linearly polarized dipole. For interesting reading about the flight tests of this repeater, see QST for January 72 page 70 and August 71 page 64.

GROUND STATION EQUIPMENT REQUIRED

Two meter transmission to the satellite will require 80 to 100 watts effective radiated power. A 20 watt transmitter and a 6 to 7 dB gain antenna is adequate, although a 50 to 100 watt transmitter and nondirectional antennas are preferred to alleviate antenna pointing problems. Any good HF receiver with 10 meter sensitivity of 1 microvolt/meter or better is suitable (assuming the local noise level does not exceed this value). The received 10 meter signal will be S-6 to 7 at best with a 0 dB receiving antenna. The most efficient modulation method for RTTY will be FSK due to the S/N advantage with BFO insertion; however, this demands continually tuning of the receiver or a tracking oscillator to compensate for the doppler shift experienced during a satellite pass (2 kHz shift during a 20 minute overhead pass). Anyone experimenting with phase locked loop tracking oscillators is encouraged to experiment with FSK RTTY or SSTV through this satellite. It is suggested that inverted FSK be transmitted so receiving stations can copy normal FSK. AM AFSK should yield copiable signals during good conditions and requires tuning only to keep the signal within the receiver passband.

PECULIARITIES OF SATELLITE COMMUNICATIONS

In addition to the doppler frequency shift, there are other signal characteristics peculiar to satellite communications. The satellite is magnetically stablized along one axis with a slow spin rate about that axis which will cause slow fading (QSB) due to antenna orientation changes. Another fade characteristic will be observed due to Faraday rotation of the polarization angle. As the signal passes from satellite to earth, the polarization of the signal is rotated due to the electron field in

CONTINUED ON PAGE 9

RTTY theory & applications·

RON 'RG' GUENTZLER, W8BBB
Route 1 Box 30
ADA OHIO, 45810

A FEW NOTES ON DISTORTION

This month we will discuss, somewhat briefly, distortion on telegraph signals.

A simple telegraph loop is shown in Figure 1. The circuit consists of the keyboard contacts, the selector magnets, a power supply, and a current limiting resistor.

When a character is "typed" on the keyboard, the contacts open and close in a predetermined pattern producing the code corresponding to that character. The current flowing in the loop will have the pattern shown in Figure 2 for the letters Y, R, and P. These patterns can be viewed on a good oscilloscope by connecting the 'scope across the current limiting resistor shown in Figure 1, or by inserting a separate resistor of 10 ohms into the loop and connecting the vertical input of the 'scope across that resistor.' For ease of viewing, it is usually desirable, but not mandatory, to send a repeated character at "machine speed." This can be done on a model 15 by lifting the lock loop cam and on a model 28 by using the repeat key.

In Figure 2 the pulses comprising the characters are all 22 milliseconds long except for the stop pulses which are 31 ms long.

Bias distortion refers to the condition when the Mark or Space pulses are too long (or short). If the Space pulses are too long it is called spacing bias and if the Mark pulses are too long it is called marking bias.

Bias distortion can be caused by several things. If, for example, a polarized relay is being used in the circuit, and it is not properly adjusted, it will tend to favor one direction of operation over the other. If the loop keying device such as a transistor is not biased properly, it will also favor one condition over the other and produce bias.

A very common cause of distortion can be illustrated with the aid of Figure 3. When a loop contains some inductance (for example, selector magnets), the current will rise relatively slowly when going from a Space to a Mark. However, when the contacts open, the current will very rapidly drop to zero. If this loop is being used to key or frequency shift a transmitter, and the keying circuit goes from Space to Mark and Mark to Space when the loop current is 30 mA, the beginning of the Mark as transmitted will be delayed in time, but the beginning of the Space will not. Therefore, the signal being transmitted will have spacing bias.

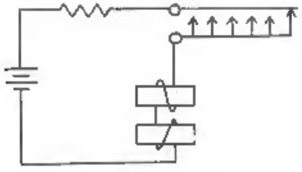


FIG. 1

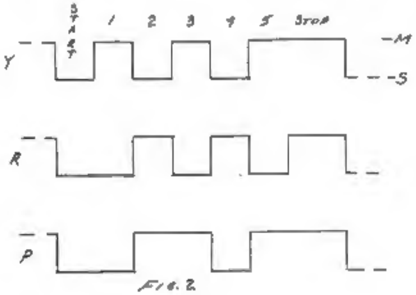


FIG. 2

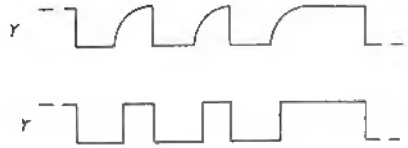


FIG. 3

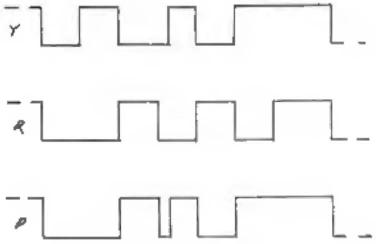


FIG. 4

Fortuitous distortion refers to the condition when the signal is occasionally chewed up. The curves in Figure 4 show fortuitous distortion caused by contact #3 or segment #3 on a keyboard being out of adjustment or worn. Notice that when a Mark is sent, it either starts late if proceeded by a Space (letter Y), or a "hole" appears if proceeded by a Mark (letter P); but when a Space is being sent at time #3 (letter R), the signal is normal. An oscilloscope will reveal this problem and indicate which contact or segment is the villain.

For an excellent, detailed discussion of distortion see: RTTY FROM A TO Z, Durward Tucker, W5VU, 1970, Cowan Publishing Co. (CQ), pages 52-59, and pages 157-166.

VHF RTTY NEWS

The following information about the German Amateur Radio Teleprinter Group, GARTG (DAFG - Deutsche Amateur Fernschreib Gruppe) was received from: Hans Jurgen Schalk, DJ8BT, GARTG VHF-Manager, 6 Frankfurt/Main 50, Heddernheimer Ldstr. 254, West Germany: "I inform our RTTY OMs about all "News" and what's happening on the VHF and UHF Bands in our RTTY-Magazine."

"To get more activity in our country, we have established the first RTTY repeater in the 2m band in Germany. Enclosed you find all technical details about our repeater. In the last months the activity increased and we could work RTTY stations from DL, LX and PA0.

"Technical details of the 2m RTTY repeater:

1. QRA: ek 63 h, altitude 880 m (near Frankfurt/Main)
2. Receiver: 144.100 MHz - Frequency Shift: 850 Hz (and all other) - AFC: -1.5 kHz - Sensitivity: 3 KT O - Drift: Maximum minus 1 kHz.
3. Transmitter: 145.900 MHz - Drift: Maximum minus 1 kHz - Power: 10 watts output.
4. Method of operation: F1, only RTTY.
5. Antennas: HB9CV beam - Polarization: Horizontal - Direction: 300 degrees (North West).
6. Period of duty: Daily 1700-2100 GMT. Add 1 on Sat & Sun 0800 - 1200 GMT.
7. Operating: Give your x-mission with some RYRY to give the AFC chance to catch your signal. The rptr xmtr works only if printing. If you stop printing it switches off after 3 seconds.

De DJ8BT."

Thanks much Hans. I hope this information helps increase your activity and gets others going.

The following, although a bit cryptic, gets the idea across well: "Dave, WA8VTK, and myself had A2X QSO on RTTY (AFSK) on 1240 MHz (APX6) 1972 JAN 01. Works great, 7.3 mile path. First in Mich.? I don't know. I would like to find out. 73, Lloyd, WA8ZCO" How about that? Any comments? Should we start a UHF/microwaves column?

That's it for this month. Keep the cards and letters coming, folks. 73 ES CUL, RG

***

OSCAR 6, cont.

CONTINUED FROM PAGE 7

the ionosphere. This rotation depends upon the vertical angle of the signal path from the satellite to receiving station. During a pass this angle changes, thus changing the polarization of the received signal. With a linearly polarized receiving antenna, this yields a 2 to 3 dB QSB with about a 5 second period. Crossed dipoles or a pair of dipoles at different polarization orientations should reduce this effect and provide adequate signals. Faraday fade does not affect the uplink 2 meter signal since the satellite receiving antenna is circularly polarized. A circularly polarized transmitting antenna at the ground station will provide a 3 dB improvement in effective transmitted signal (Northern hemisphere use a right hand polarization). The expected one year lifetime of AO-C should provide incentive for some experimentation with antennas for ground stations.

COMING SOON

Future articles are scheduled to describe the CODESTORE system and planned modifications to provide RTTY data storage. The Morse code telemetry format and relaying methods will be described and orbit information needed to determine when the satellite will be within range of your station. The additional information on the AO-B equipment including the RTTY telemetry format will be deferred until launch date is scheduled for that satellite.

***

RTTY-DX

JOHN POSSEHL - W3KV
Box 73 Blue Bell, Pa., 19422

Hello there . . .

To continue with the Odyssey to the Atolls of the Pacific. Paul arrived at the various places on schedule and although he does not consider the trip as being a hugh success in the number of contacts made the experience factor was of tremendous importance and he now has a much better idea as to what to expect on the next trip to that area. Yes, he will be making another journey to the same area in a very few months. Most of the contacts made were in the areas bordering on the Pacific; JA, VK, and mainly the western USA. There were a few lucky fellows further East like WA3IKK and WA4KEY that were able to make contact with Paul but no luck in Europe, Africa, and South America. What Paul would like you fellows to do is to get in contact with him during the next several weeks, and based on your knowledge and experience with the propagation from your area to the Central Pacific area, pass on to him information as to the best times and frequencies and he will do his best to see that all areas of the world are covered on the next trip. You must take into consideration of course that in a DXpedition of this type the operation usually takes place using QRP portable equipment (a FT-101 and Mite in this instance) a hastily strung dipole between anything that resembles a pole, and a day or two of intermittent operating at most from any one place. To those interested Paul says that he is willing to make schedules before the next trip based upon your information as to the best time and frequency.

In his brief travels Paul found that the Trust Territory is releasing their Model 14 and 15 equipment as obsolete and machines should soon be available to hams in the area at little or no cost. KC6BW on Ponape is interested in RTTY and KX6IQ in the Marshall Group is building a ST-6 at the moment, so Paul's missionary work may yield some permanent activity in the months ahead.

While we were wearing out the receiver dial here looking for Paul we did copy some big signals from Cuba. Conrado, CO7CD; Eduardo, CO7RR; and Albeico, CO7AG are all active but all use the same equipment located at the local club station. Eduardo, CO7RR, in particular has been very active on 14 mhz at almost any time and many of you have this new country in your log by this time. Patience is required as the operating is slow and the boys do not speak English. If you still remember your high school Spanish by all means use it as it would be a great help in the QSO. QSL's for all calls can go to--

P.O. Box 52
Camaguey, Cuba.

As we have mentioned from time to time, Olle, SM0KV is not too active from the home QTH but you are very likely to hear him from some of the more exotic spots around the world. We received a card from him while he was in Kenya and at that time he was trying to get Robbie, 5Z4EER on the bands with a TU and a LO 15 machine. Well the card arrived about three months after it was mailed in spite of the fact that the reverse side had a picture of a large modern Jetliner. As we had not heard of any activitiy from Kenya we assume that Olle had to leave before he was able to get things going. We may have more about this later. Olle also stopped off at YA1OS, and as you know, this station is now ver, active. Robin, G8LT, passes along his QTH as-- P.O. Box 5, Kabul, Afghanistan.

Arthur, ON4BX, reports that Gene, UA9PP is very active and that now his signals are adjusted for good wide or narrow shift. This along with the activity of UK9OAA as reported by JA1ACB last month makes two stations active in Zone 18. This could possibly be one set of equipment as we understand that hams frequently use their own calls when operating from club stations. QSL's should go via the bureau.

We were pleased to hear from G3LDI recently and Roger passes along some very good news indeed. He recently sent a complete Model 19 to Barney, VP2AA, who is located in St. Johns, Antigua. Barney is presently building up a TU so don't be surprised to hear RTTY signals from this spot in the very near future. There are several more VP2 prefixes in the Leeward Island group and as each counts as a separate country let's hope this may be the start of bigger things to come.

We certainly all wish to extend congratulations to Giovanni, I1KG upon his receiving "100 RTTY-DXCC" Award Number 3 as issued by the RTTY Journal. In checking the cards we noted that the first was from 5A5TR, Libya, dated May 22, 1965 and the most recent from FR7AB dated December 5, 1971. To give you an idea of some of the DX that has been available on RTTY over the past few years here are a few of the more exotic QSL's from Giovanni's group. JX5CI, Jan Mayen; I1AMP/M1, San Morino; GC3PLX, Channel Islands (Sark); FB8ZZ, New Amsterdam; ZS2MI, Marion Islands; and 7Q7JO, Malawi.

The first W A C Award to be issued in 1972 goes to--

Nr. 182-John P. Harrison W5TZB

John is quite new to RTTY, having been on for about six months and he is located in the state of New Mexico for you fellows trying for WAS.

From Glenn, K3SWZ we hear that K5CNZ/YV5 is quite active and that he QSL's rapidly if you send yours to--

Jim Murray
c/o Creole Petroleum Co.
Apartado 889
Caracas, Venezuela

Fred, YB0AAO is definitely active as we heard him in QSO with Paul, EI5BH recently at 1230z on 14 mhz and with excellent signals here on the East Coast USA.

With the higher frequency bands closing down quite early these days it may pay to look in on 40 Meters during the evening hours for some DX possibilities. We understand that DL8VX and DL2AK will be on that band every Thursday at 2300z looking for some contacts into North and South America. The exact frequency was not mentioned so on that band it would pay to look around both 7090 and 7040 khz.

See you next issue.

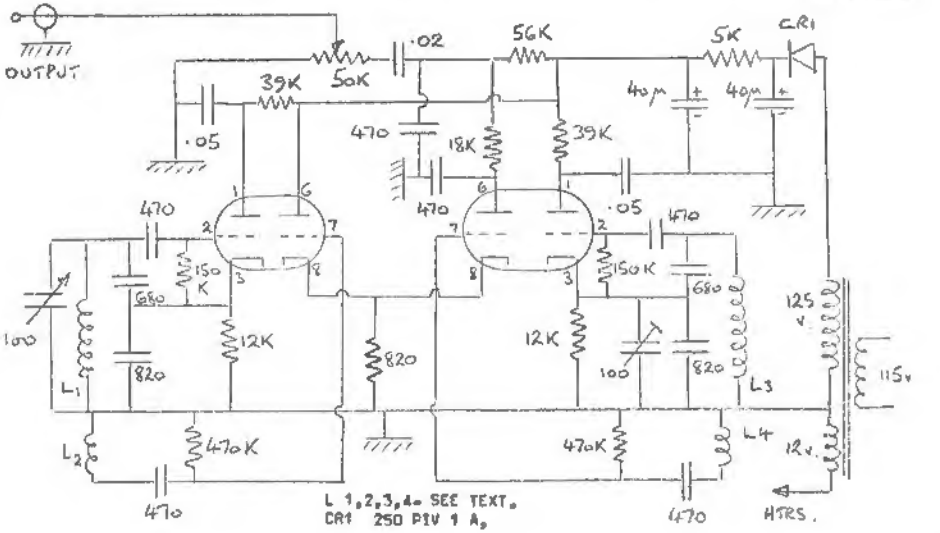
73 de John

*****

A Junk Box Audio Generator---

CRAWFORD MacKEAN G4ARR/W2
P O Box 93
CONVENT STATION, N.9 N.J. 07961

You can get just so far building a TU before an audio generator becomes a necessity rather than a luxury, and when I reached that point a few months ago, the $50 tag on most kits looked distinctly unattractive. Some years ago, when I was in the business of transmission testing on audio frequency telephone cables, our faithful standby was an old favorite now hardly ever seen, the BFO audio generator. Simple, reasonably stable, quite tolerable waveform if you aren't in the Hi Fi business, and uses commonly available junk box bits and pieces. Linear, to a reasonable approximation, over any audio range



you want to name; I chose 0 - 10 KHz.

As you can see from the circuit, two RF oscillators, Colpitts, feed a conventional two triode product detector, the output at the difference frequency being the audio and a simple RC filter removing the RF components. The oscillator coils might not be too easy to duplicate, 8 mH air core pile wound. Originally mine were probably TV components, out of a 99c "surprise inductor package", but stripped of about two thirds of their turns. They should resonate at about 100 KHz or so with 390 pF across them, the tuning range of the variable oscillator being about 90 - 100 KHz. The two coils should be mounted with some separation and shielding between them, say above and below the chassis to minimize coupling and pulling.

One point worth noting is that the output waveform improved beyond recognition by taking the product detector inputs from taps, or in my case separate windings which were available, on the tuned circuits (tapped at about 2% of turns I estimate), rather than from the oscillator cathodes.

Almost any twin triode will function. I have tried 12AX7, 12AU7 and 6211. The tolerance to junk box components is good, provided you use them similarly in the two oscillators. The B + line runs about + 150v. driving the tubes quite gently and holding zero beat is no problem at 100 KHz.

The oscillator was calibrated the hard way against a 100 KHz crystal oscillator with divider outputs to 1 Hz and against the harmonics of those outputs with a scope and Lissajou's figures. Accurate, but not recommended unless you have a lot of time and a fair supply of patience on hand. A counter would be one great deal easier.

Components as I have said should be no problem. The air variable should be a fairly good quality linear though. If you don't have any 12AU7s around anymore, Burstein & Applebee in Kansas City has 6211s at four for 99¢ and the power transformer is a MW4534 from Fair Radio Sales, Lima, Ohio.

*****

FASTER SPEEDS-cont.

CONTINUED FROM PAGE 2

would call for using 60 wpm for calling and then switching to higher speeds for communication - if desired.

This proposal has considerable merit in its organized attempt to avoid confusion and false operation of equipment as can be testified by the lack of any opposition when discussed at all Chicago area RTTY clubs and in other adjacent states.

*

Dear Dusty:

With only a few days of legal variable speed operation I have noticed several things.

Going to 75 or 100 WPM is silly for the fellows that can only type with one or two fingers at 15 or 20 WPM and it confuses the beginner as he hears the slow typing and wonders why he can't print it. He doesn't know if his TU is out of whack or the speed is wrong.

Think the fellows that are on a faster speed should identify their speed during the CW ID.

60 WPM - No speed ID.
67 WPM - CW ID then 5
75 WPM - CW ID then 7
100 WPM - CW ID then 1

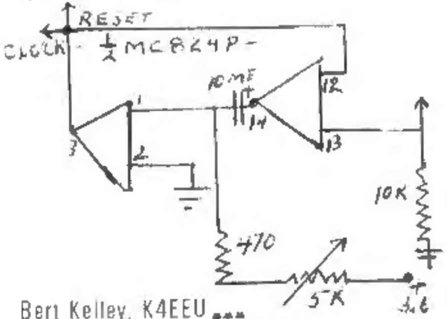
Then the plutocrats with the gear shift in their 28s can shift gears and us poor peons with the 15 and 26s can look for another station.

What we need is some gadget to tell the speed even though they are typing at 15 WPM.

CW ID to follow,
Harold Roth, WØLFH
615 E. 20th St. S. Sioux City, NB. 68776

CORRECTION- Please---

It has been called to my attention that there is an error in the schematic for the Digital TD in December 1971 Journal. In the stop pulse generator monostable the top end of the 470 ohm resistor should connect direct to pin 2 (orl) of the MC824P quad Nor gate integrated circuit, with the 10 mfd capacitor relocated between this junction and pin 14. Or, in other words, draw a line through the ten mfd capacitor where it is shown on the schematic, and draw a new one in on the schematic about 1/8" to the right.



Bert Kelley, K4EEU ***

HITS & MISSES

From The Editor and his Mail

Among other things, Santa Claus brought us a little 1 gal. wine making kit. We read the schematic and followed directions but alas Murphy seems to carry over into everything we do so after a couple of days bubbling - it quit.. And that is about what happened to our request for some articles for our wine barrel of articles. We got a couple (and are grateful) then the bubbling quit and the barrel now is darn near empty. This issue turned into a frequency measuring reference but this is something we all need at some time so if not interested now file it away for the future.

***

India, Bangkok, Hong Kong, Manila, Japan, Hawaii, San Francisco, Los Angeles, Chicago, Detroit, Niagara Falls, Washington, New York, London, Rome, Tehran and back to India. This is not a list of DX countries but the route now being taken by Venkat, VU2KV on a trip with his lovely xyl Rhotta. We were very pleased to have Ven include a stop in Detroit for a half day during his busy schedule. Ven says that equipment and many components are hard to get in India because of import restrictions.

Even so many of the hams find "ways" of obtaining things and make up in good operating and technique for any equipment handicaps. As many RTTY fans know Ven has put India on the RTTY country list and although he is not able to operate as much as he would like will be on again when he reaches home. Ven and his xyl will be in England for about three weeks before returning home probably about the middle of March. We are sorry his stay was so short but as usual it was a real pleasure to meet a friend that we had talked to over the air for several years.

***

The foreign RTTY societies do seem more active than any in this country. The Swiss recently held a RTTY meeting with over 75 in attendance according to Karl, HB9P. A number of RTTY hams from surrounding countries were on hand, and from the number attending, in comparison to the number we have heard on the bands and those in attendance much of the activity must be on the none DX bands or just SWLs which is about the same as in this country.

***

We have quite a few orders for binders that we are holding until our new shipment arrives. Delivery has been promised week of February 7th so maybe they will have arrived before you read this.

***

BACK ISSUES-

New subscriptions and classified ads are cash in advance as we have no method of billing. New subscriptions will be started with the current issue and one back issue if requested. Please do not ask us to start any further back than this. If available, back issues may be ordered at 30¢ each at time of subscription. The Journal is mailed about the 20th of the month preceding the dated month.

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HAL DEVICES: ONE SOURCE FOR ALL your construction needs. Our line of resistors, capacitors, and semiconductors will fill your requirements for practically any project. TTL devices are stocked in volume to support production of our keyers, identifiers, and the fantastic RVD-1002 RTTY Visual Display System. Fast service at reasonable prices. HAL DEVICES, Box 365RJ, Urbana, Ill. 61801 Phone 217-359-7373.

TYPEWRITER RIBBON REINKER, Hand operated model now only $3.50. K575 or K764 Ink available at all National Cash Register Co. stores at 75c per tube. Walter Nettles W7ARS-8355 Tanque Verde Rd. Tucson, Ariz. 85715

MORE RTTY! THAT'S RIGHT. In 1970 there were more feature RTTY articles in HAM RADIO Magazine than any other general amateur magazine. You need RTTY Journal, but you need HAM RADIO also. $6.00 per year; $12.00, 3 years. Ham Radio, Greenville, N.H. 03048

WANTED-COLLINS 399C-1 PTO Console. 32W-1 exciter. National HRO-7 receiver. All in any condition. G.S. Naniwada, JA1ACB. 3-4-8, Izumi, Hoya Tokyo 188, Japan.

4-1000 TUBE, NEW. $75 24C w/ probes $60. TS34A scope $25. HP560 digital recorders $80. I 193 manual and chest $12. TEK 514AD $135. DYMEC 25038 6 digit $150. USM 105 $425. USM 105 $350. GR1330A, $290, with manual, adaptors and calibrated $360. TDA2 $35. GR1001-A Lavoie Labs LA20M Spectrum analyzer with 120 tuner, no plugins or extra parts to buy, $350. SASE for list of excess and new components. HP425A $40. Kintel 203A, $90. Trade your list for mine. Douglas Craton, 5625 Balfrey Dr. West Palm Beach, FL. 33406.

FOR SALE: 28ASR and 28KSR. Both with floo. consoles, 60 and 100 gears. Auto CR/LF, non overline, unshift on space. Model 19 with table and TD. Wanted multi-freq. HT-220, HP525A and 525B plugins. Make an offer, I need money so will sell cheap. Write or call - 1722 S. 125th East Ave. Tulsa, OK. 74128. (918)-437-4969.

W.C.I. PHASE LOCKED LOOP TU- completely wired and tested, plug-in PC boards with sockets, now available for $100.00. All you add is 12 volts and your loop supply. Full 2 year warranty on boards. AFSK and weak signal detector boards soon to be available. SASE for RTTY buyers guide. W.C.I. PO Box 17, Schaumburg, Ill. 60172.

SALE; MODEL 14 TYPING REPERFS - send receive, complete with cover, sync motor, keyboard, end of line, indicator, excellent $37.50 Model 14 transmitter - distributor, complete with cover, sync motor, excellent $20. ea. Model 28 type box, complete, excellent $15. Platen for model 15 teletetypewriter rubber covered, unused, $4.00 Tuning Fork (speed indicator) 96.19 V.P.S. with instructions sheet for using tuning fork to set motor speed of teletype equipment to operate at speeds of 368 O.P.M. and 404 O.P.M. Unused $2. ea.-3 for $5. Drum, fascimile, key design 12-1/2" long, 6" dia, unused $8. ea. Atlantic Surplus Sales, 580 3rd Ave. Brooklyn, N.Y. 11215.

HAL DEVICES: HEADQUARTERS for MAINLINE Solid state RTTY equipment. You can do no better than the ST-6 demodulator at any price. Screened, punched cabinets for the ST-6 will be available soon. For budget TTY, consider the RT-1 for VHF, the ST-5 for HF. And the best in AFSK is provided by the AK-1. Our new model 1550 electronic keyer, or the MKB-1 Morse Keyboard, will automatically identify your RTTY station at the push of a button. The extra values are available from HAL Devices, Box 365RJ, Urbana, Ill. 61801. Phone 217-359-7373.

BACK ISSUES - RTTY JOURNAL - Have all issues from Vol. 1, No. 1, will reproduce any issue for $1.00 PP. John Isaacs, 3175 Val Verde Ave. Long Beach, Cal. 90808.

TELETYPE MACHINES, TABLES, COVERS, power supplies, reperferators, cabinets, tape punches, parts etc. Loads of electronic equipment and parts also. PC boards, Western Union items, clocks etc. Goodman 5826 S. Western Avenue Chicago, Illinois 60636 (312-476-8200).

HAL DEVICES: Announces the revolutionary new RVD-1002 and RKB-1 solid state RTTY system. Provides the ultimate in noiseless, reliable reception and transmission of Baudot coded TTY. The RVD-1002 visual display system receives demodulated TTY pulses from the ST-6 and provides video output to a video monitor, or modified TV set. One thousand (1000) characters are displayed in a 20 line, 50 character per line format, at 60, 66, 75, and 100 WPM if your TU will copy it. The RKB-1 combines reliable TTL circuitry, a high quality commercial keyboard, and a rugged case to provide the best Baudot TTY keyboard available.. The electronics is arranged so that you type as if you were using a typewriter. See them on display at SAROC, Wheaton, and Dayton. Get the details from HAL Devices, Box 365RJ, Urbana, Ill. 61801 Phone 217-359-7373.

FM MOTOROLA SCHEMATIC DIGEST - 136 giant pages 11-1/2 x 17 schematic diagrams, alignment instructions, crystal information, trouble shooting information. $6.50 postpaid. S.M. Wolf, PO Box 535, Lexington, Mass. 02173.

MODEL 15 PLATEN HANDLE - $3; Perforator tape, 40 roll case - $6.50; Model 14 TD - $22; 3-speed gear shift for M28 TD (#195442), new, in original boxes - $48; 8-1/2" wide fan fold paper - $3.00 per box; M28 reperf covers like new - $12.00; M14 typing reperf, good condition $25.00; Sweep frequency audio generator: 1/2, 1, 2 & 4 RPM - $35. Jim Cooper, POB 73, Paramus, NJ 07652.

TOROIDS, 88mm. UNCASED - 5/$1.50 pp, W9FTE, Dick Sanborn, 8800 W. Clovernook Ct., Milwaukee, Wisc. 53224.

TM 11-2216 ON MODEL 19, $10. TM 11-2222 on 14 TD, $6. TM 11-2223 on Model 14 Reperforators - Typing & Non-Typing, $10. TM 11-352 on Model 15, $4.50. NAVSHIPS 93241 on Model 28 KSR & RO. $7.50 TM 11-2230 on TT-98, TT-99, TT-100, $7.50. 103628 tuning fork, 87.6 vps, new, $7. All above postpaid. Small, lightweight 130VDC, 200MA loop supply, $6.50. Large SASE brings list of manuals, TTY parts, etc., for sale - wanted - swap. W4NZY, 119 North Birchwood Ave., Louisville, Ky. 40206 - 502-895-3275.

MODEL 35 KSRW/FLOOR STAND, checked for operation, cabinets need to be cleaned or painted. Crated $450. Model 35 cleaned, lubed, cabinets painted, $560.00. IBM model 1316 disc pac for RCA comp. or memorex disc drive. New original boxes, $175. Ea. Wanted; manual set for 35ASR, manual set for 37KSR, RO set for model 37ASR. Douglas Craton, 5625 Balfrey Dr. W. Palm Beach, Florida 33406.

SELL: BASE AND COVER MODEL 14 Typing Reperforator, $10.00. I now have keyboard base! Pick up or pay shipping. Jim Throop, W1FLN; 99 Sand Hill Drive, North Kingstown, RI 02852.

SALE - MODEL 28KSR with 3 speed gear shift - 60-67-100 wpm, Auto CR/LF, excellent condition $250.00. Harry B. Wood, 34753 Rancho Vista, Palm Springs, CA. 92262.

WANTED TO BUY; CV89/URA-8A audio discriminator converter. Gordon Heffernan, 816 North 11th St., Manitowoc, Wisc. 54220.

MODEL 28 KSR's - EXCELLENT CONDITION, $285.00 FOB Berkeley, California. Typing units cleaned, lubricated, and adjusted for better than 92 points of range at 100 WPM; keyboards cleaned, lubricated, and adjusted for minimum distortion with a distortion analyzer; cabinets refinished. Price includes 60 and 100 WPM gears. Console or desktop cabinet - state first and second choice if any. Ronald Ott, 2320 C Parker Street, Berkeley, California 94704.

WANTED: 8116 AND 8233 TUBES, R-1051/URR, AN/WRC-1 and AN/URC-35 equipment. SELL: Collins 618S-1/ARC-38 transceivers, BC-611 walkie-talkies, AN/USM-25A 'scope, Collins 75S-1 receiver, HP-523D counter, HP-512A frequency converter, 10 MHz. scalar. Ronald Ott, 2320 C Parker Street, Berkeley, California 94704.

CHICAGO AREA TELETYPE HAMS Teletype repair work performed at reasonable prices. Qualified on all Teletype Corp. Units. Write: Neil Petlock, 5213 N. Olcott, Chicago, Ill. 60656 or call 631-6889.

SALE; MODEL 28 TYPING REPERFORATOR Transmitter or "RT" mounted on a tape handling stand which includes large tape take up and supply reels as well, as an intermediate storage bin. O/A dim. 36" high, 20" long and 8-1/2" wide. Both LAXD-4 transmitter - distributor and LPR-3 typing reperforator come equipped with three speed gear shift. Allowing down speed conversion as well as up speed conversion. Synchronous motor LMU-12, excellent $150.00. Atlantic Surplus Sales, 580 3rd Ave., Brooklyn, N.Y. 11215.

HIGH POWER COMPONENTS: Johnson rotary inductors 13.5 uh 10 amps $20. Johnson 250 uufd 7KV variable capacitors $5. 100 ufd 3 KV oils $20. 110/220 to 2.4 KV @ 2 amps $20. 110/220 to 7.2 KV @ 0.7 amps $20. 20KV micas @ $5 write, all FOB: D.R. Kelley, 1490 Yaqui Dr., Florissant, Mo. 63031.

MODEL 19, COMPLETE AND RECONDITIONED, very good, $110.00. 2 model TG 7-B (15RSR), good condition, $35.00 ea. or $60.00 for both. Sorry, can't ship. Paul Beavin, WB6NLT, 1 Adams Ct., Novato, Ca. 94947. 415-897-8843.

WANTED - LESU-11 or 28-C Electrical Service Unit; Model 28 Keyboard; 28 Tabletop Cabinet; LARP-4 & LARB-5 - for cash or trade. Sell KY-45/FRT-5 Frequency Shift Keyer by Collins, $25, like new. Will trade, W4NZY, 119 North Birchwood Ave., Louisville, Ky. 40206 - 502-895-3275.

HAVE 35ASR COMPLETE - all units in good working order but not wired. Includes 101 data set. Want screw cutting lathe with accessories. Must be in Detroit area. Write details to N.D. Frede, 8886 E. Outer Dr. Detroit, MI. 48213 or call 313-521-1461.

IC's CHEAP - HAVE MANY popular types, EX 7400 - 22c ea. 7474 - 75c ea. 74107 - 80c ea. 74122 $1.90 ea. LM309K - $3.75 ea. 7090 Pamp 50c ea. For list send SASE - Mark Eastwold, WA0PJF, 366 Scobey, Brookings, S.D. 57006.

FOR SALE: LAVOIE LABS SPECTRUM ANALYZER LA-18 complete with tuning unit 10mhz-10 ghz excellent $350.00; PANORAMIC ULTRASONIC SPECTRUM ANALYZER MODEL SB-7BZ range 1 - 300khz new unused $250.00; Will trade even up for a Model 28 KSR either of the two items listed above. Lou Carbaugh P.O. Box 398, N.C. Pa. 17070 - 717-774-2100.

SELL: 28KSR, VERY CLEAN CONSOLE. Recent commercial unit, complete professional maintenance. Electric paper takeup attached. 60 wpm. Pickup, nearby delivery. Offer? K2LNG, RD 1, Box 63A, Rensselaer, N.Y. 12144 (518) 283-6471.

FOR SALE: Model 14 typing Reperf, Model 14 Transmitter Distributor. (2) New Teletype Tables with felt pad tops and electrical service unit. Jack Hardman K2MVR (201) 751-3000 days; (201) 239-1050 nights.

FOR SALE; 1-28KSR (3 speed) excellent. 1 15KSR (60 speed), excellent. 1-Kleinschmidt TT271/FG (3 speed), needs some work. 1-32ASR (60) speed, with TD and reperf working. (Typing head and keyboard off but have all parts for a handy man to make complete unit). 1 - Teletype Corp. tape punch with homebrew power supply. 1 - 14TD (75 speed) needs some work. 1 - Heathkit Apache transmitter, 150 watts, 170-850 shift. Includes all books and manuals. Asking $850.00, will not sell separately. Contact Frank Franzoi, 198 Lincolnshire, Crystal Lake, Ill. 60014. Tel after 7 P.M. 815-459-7952.

COMMERCIAL TYPE TELEGRAPH MONITOR MT-1 and power control unit MPS-1 110 v.a.c. by STELMA, Inc. Used to analyze teletype signals. Orig. cost $350.00 asking $70.00 FOB. Andy Clark W4IYT 41 Lenape Dr., Miami Springs, FL. 33166.

YOUR CALL IN THREE INCH raised letters (3D) on 4 x 20 inch magnetic Sign. Choice of red, black, blue, orange or green lettering on white background. $4.00 ea. or two for $7.50 PP. Signs by Martin, WB6INV, Box 46, Northridge, CA. 91324.

SALE; W.E. 314B is modern mercury wetted reed replacement for W.E. - 255. Plugs right in. All tested - $4.00 pp. Jim Kirkpatrick, 1214 N.W. 2nd Ave., Fairbault, Minn. 55021.

MODEL 28 TYPING REPERF TRANSMITTER, complete with tape handling stand, reperforator distributor unit, Synchronous 1/2HP motor and two tape reels. 115V 60cy AC. .5 amp max signal input/output 130 V max DC .075 amps max. O/A dim. 36 inches high, 20" long, 8-1/2" wide. Trans- dist. is type LAXD4 with 3 speed gear shift. Typing reperf is type LRXB6 also with 3 speed gear shift. Used, excellent $150.00 each while they last. Unused parts for model 14,15,19,28, Mite and Kleinschmidt machines. Send us your requirements. Atlantic Surplus Sales, 580 3rd Ave. Brooklyn, N.Y. 11215.

Additional Classified On Page 16